

INDUCTIVE PLASMA PROCESSOR HAVING COIL WITH PLURAL WINDINGS AND METHOD OF CONTROLLING PLASMA DENSITY

Abstract of the Disclosure

An inductive plasma processor includes a multiple winding radio frequency coil having plural electrically parallel, spatially concentric windings (1) having different amounts of RF power supplied to them, and (2) arranged to produce electromagnetic fields having different couplings to different regions of plasma in the chamber to control plasma flux distribution incident on a processed workpiece. The coil is powered by a single radio frequency generator via a single matching network. Input and output ends of each winding are respectively connected to input and output tuning capacitors. In a first embodiment, the location of maximum inductive coupling of the radio frequency to the plasma and the current magnitude in each winding are respectively mainly determined by values of the output and input capacitors. By adjusting all the input and output capacitors simultaneously, the current to a winding can be varied while the current to the other winding can be maintained constant as if these windings were completely de-coupled and independent. Therefore, the capacitors can control the plasma density in different radial and azimuthal regions. In another embodiment, a relatively low frequency drives the coil whereby each winding has a relatively short electrical length, causing substantially small standing wave current and voltage variations. The output capacitor for each winding adjusts current magnitude, to eliminate the need for the input capacitors and reduce operational complexity.